MOTION

Water treatment plants

Providing clean and safe drinking water for a sustainable world

Benefits of improving efficiencies throughout a water facility

Urban water use typically accounts for 70 percent of the electricity associated with water supply and treatment. Water use efficiency, as well as applying the latest innovations, helps avoid the need to develop new water supply infrastructure.

Plant and personnel safety

"We must maintain water quality and quantity requirements, while exceeding safety standards and complying with legislation."

Safety Manager

Tackle diverse safety demands...
Choosing innovative technology can help tackle stricter anti-pollution laws and water quality standards.

...using best-in-class technology

Wheeled module drives can be rapidly manoeuvred into a panel, eliminating manual lifting which could lead to injury and reducing time exposed to potentially dirty environment.

Arc flash mitigation protects staff by ensuring all panels undergo arc flash testing.

Tested, validated solutions lower risk, save design time and secure your implementation.

Remote monitoring support for your entire powertrain using digital solutions like condition monitoring or remote visual guidance. Service engineers can now provide their assessments remotely, minimizing potential health and safety risks, and reducing downtime and total cost of ownership.

Safe torque off built into variable speed drives, brings motor-driven applications to a safe and efficient stop.

Globally certified drives and motors packages protect plant and people and conform to worldwide regulations using tested and certified motors and drives for potentially explosive atmospheres.

Energy efficiency

"Our aim is to optimize operating costs and environmental efficiency."

Energy Manager

Know where to look...
With pumps, motors and other equipment operating 24 hours a day, seven days a week, water facilities are among the biggest consumers of energy and, therefore, among the largest contributors to total greenhouse gas emissions.

...and how to unlock the saving potential

Energy optimization is a dynamic control within a drive that adapts to changes in the motor load and reduces the energy needed to deliver the required torque.

Energy monitoring is built within a drive and works out energy savings in kWh, MWh, CO_2 emissions and money saved.

High efficiency VSD/VFD-motor package lowers energy use between 20 to 60 percent and reduces carbon dioxide emissions.

IE5 synchronous reluctance motors (SynRMs) reduce losses by up to 40 percent in comparison to standard IE3 induction motors, bringing optimal efficiency and reliability.

ABB Ability™ Condition Monitoring for powertrains.

ABB energy efficiency services assist in identifying energy-saving opportunities among electric-driven motors in rotating-equipment such as pumps and fans.

Productivity and resilience

"We must maximize capacity, availability and uptime."

Production Manager

Build in resilience...
The primary aim is to reduce the total cost of ownership and energy consumption through asset monitoring and optimization solutions. Non-revenue water is a huge issue, including leaks due to water hammer, and pressure fluctuation.

... with flexible motor-driven solutions

Matched drives and motors packages ensure correct dimensioning of the drive and motor and guaranteed package efficiencies.

Power quality can be improved using ultra-low harmonic (ULH) drives, which do not generate harmonics, reduce losses in the mains supply and mitigate the risk of disturbances to other equipment connected to the mains. Using ULH drives with generators reduces the generator size and allows for better generator stability.

Long cable runs are common in water applications and the drive may require additional filtering or more engineering to minimize the impact on the installation.

Cyber security is paramount by ensuring that drives can be integrated into a system that meets IEC 62443 requirements.

Fieldbus communications offers greater flexibility than point-to-point hardwiring, thereby improving the information sharing between the drive and other connected devices.

Communications loss backup mode enables the drive to automatically switch to internal PID control, allowing for resilient operation of the system while maintaining accurate control of the process, rather than using fixed speed backup modes.

Tailored service agreement – partnering for an outcome based objective, service experts guarantee availability and uptime, helping you plan, coordinate and execute your equipment maintenance according to its criticality.

Operation and maintenance

"We need to manage unexpected emergency breakdowns, while extending the life of our installed equipment."

Maintenance Manager

Lower operational overheads...
Preventive maintenance planning is critical for maximum powertrain availability, quality of operation and lifetime, predictable budgeting and cost management.

... by utilizing smart functionality

Life cycle assessment provides a clear understanding of the drive/motor installed base, detailing how assets will evolve over the next few years.

Preventive maintenance plan provides regular inspections and component replacements according to a product-specific maintenance schedule.

Genuine spares must be readily available locally. Online ordering facilities should provide 24-hour access.

PC tools provide optimal commissioning and monitoring software that stores drive parameter sets and operation and maintenance documentation. Allows customization of the drive, reducing the need for a PLC.

Tailored service agreement that provides all the life cycle services necessary to keep your equipment operating reliably, tackling proactive and reactive maintenance needs.

Plug and play digital solutions such as smart sensors and connected drives, securely collect data from your applications, providing deeper status insights and a true indication of the condition of your installed base.

Temperature, load, under/overvoltage protection and warning features in drives help prevent breakdowns.

Increased motor lifetime thanks to lower winding and bearing temperatures in SynRM.

Finding improvements every step of the way

Every stage of water treatment can be fine-tuned to ensure a quality that exceeds drinking water guidelines, is cleaner, and smells and tastes better all year.

1 RIVER ABSTRACTION

River water quantity and quality depends on its run-off system, seasonal changes and the general soil and vegetation through which it flows en route to the sea. Several methods enable river water abstraction and river abstraction is usually controlled through abstraction licenses.

Applications:
- Centrifugal and submersible pumps

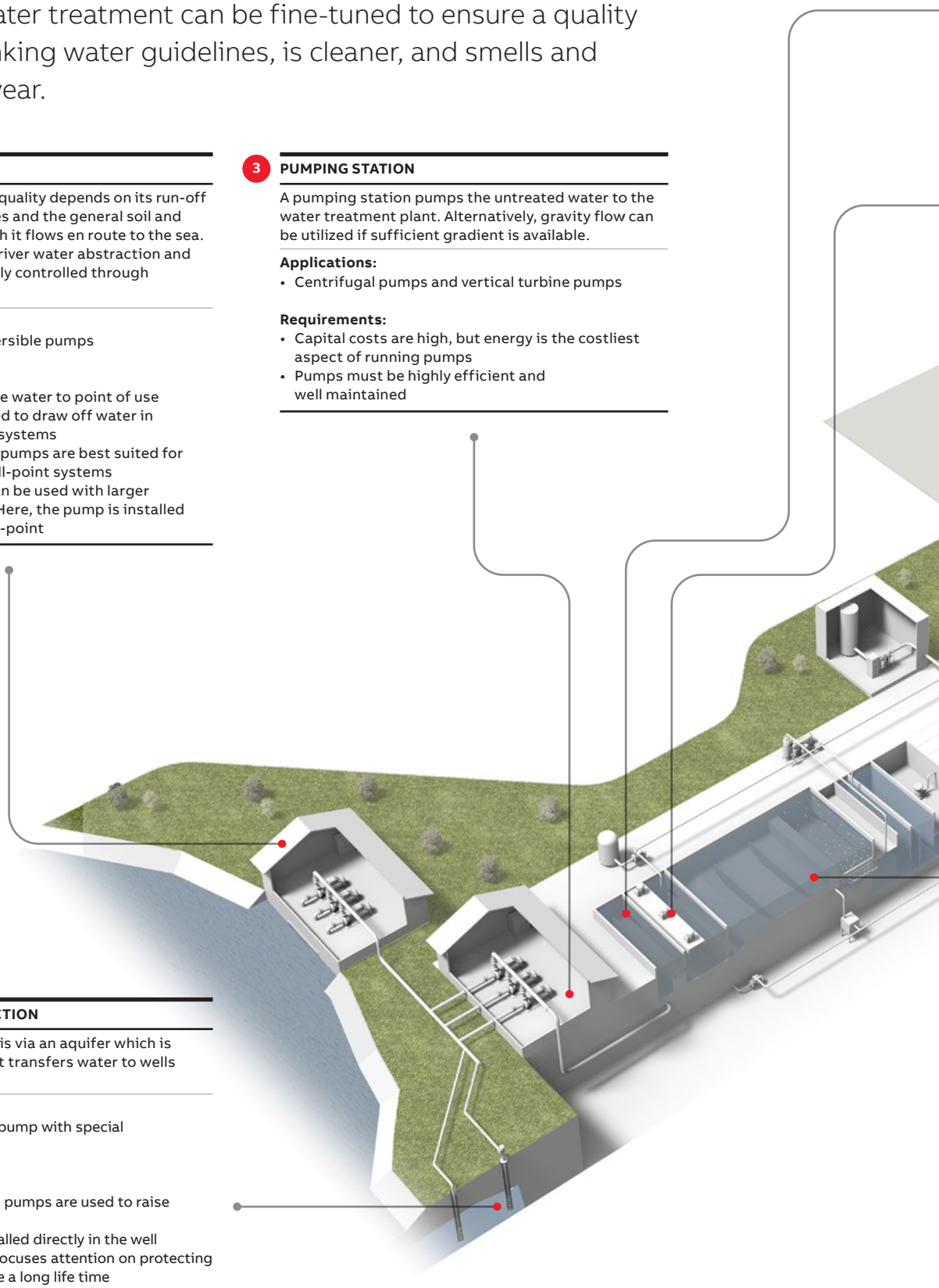
Requirements:
- Pumps are used to raise water to point of use
- Suction pumps are used to draw off water in small-scale well-point systems
- Piston and centrifugal pumps are best suited for single and multiple well-point systems
- Submersible pumps can be used with larger diameter well-points. Here, the pump is installed directly within the well-point

3 PUMPING STATION

A pumping station pumps the untreated water to the water treatment plant. Alternatively, gravity flow can be utilized if sufficient gradient is available.

Applications:
- Centrifugal pumps and vertical turbine pumps

Requirements:
- Capital costs are high, but energy is the costliest aspect of running pumps
- Pumps must be highly efficient and well maintained



2 GROUNDWATER EXTRACTION

Groundwater extraction is via an aquifer which is a water-bearing rock that transfers water to wells and springs.

Applications:
- Multi-stage mixed flow pump with special submersible motor

Requirements:
- Submersible centrifugal pumps are used to raise water to point of use
- Pump and motor is installed directly in the well
- High installation costs focuses attention on protecting well and pump to ensure a long life time
- Configurable ramps in the VSD/VFD for reducing turbidity and for gentle check valve operation

4 CHEMICAL COAGULATION

In a water treatment facility, the coagulant is added to the water and it is rapidly mixed, so that the coagulant is circulated throughout the water. Chlorine dioxide is added to break down matter such as decaying leaves. Aluminum sulfate is used as the main coagulant. A polymer is added to strengthen the primary coagulant's bonding chains.

Applications:
- Pumps
- Mixers

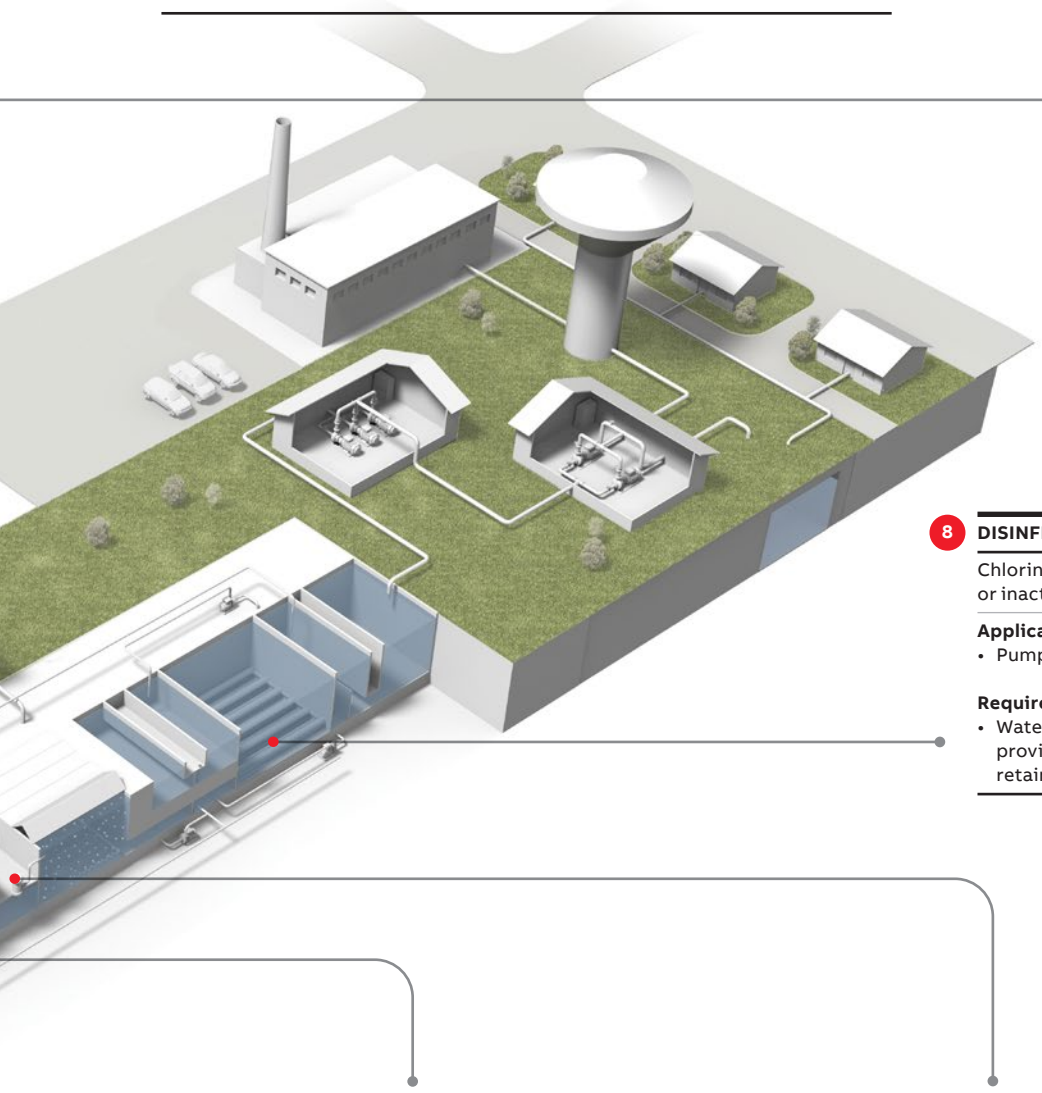
Requirements:
- Once chemicals are added, rapid mixing thoroughly disperses the chemical coagulants, evenly distributing them throughout the raw water
- Fine particles clump together and are removed during the treatment process by settling, skimming, draining or filtering

5 FLOCCULATION

A slow mixing process that causes small coagulated particles to form larger particles called floc.

Applications:
- Mixers/stirrers
- Pumps
- Skimmers
- Aerators

Requirements:
- The contacts or collisions between particles require gentle stirring created by a mixing paddles



8 DISINFECTION

Chlorine is used within the disinfection process to kill or inactivate water-borne microorganisms.

Applications:
- Pumps

Requirements:
- Water flows gradually through a series of baffles, providing time for additives to mix thoroughly and retain contact with disinfectant for longer

6 SEDIMENTATION

Removes particles suspended in water to reduce the load on the filters.

Applications:
- Filter pumps
- Aeration compressor

Requirements:
- Sedimentation is the process by which solid particles suspended in water settle at the bottom of the tank, through forces such as gravity. The particles form a sludge which is then removed via a sludge pipe
- Clearer surface water is collected from the tank

7 FILTRATION

Water is filtered through a granular material such as coal or sand to remove any final impurities not collected during stage 6.

Applications:
- Pumps
- Mixers

Requirements:
- Pumps optimize the filtration process
- Filtration process can be controlled/supervised on: pressure, volume, temperature etc.
- Filters will decay over time, changing pump's load point
- Filtration process is subject to strict control as it is critical to quality of water leaving facility

Water distribution system

9 MAIN DISTRIBUTION PUMP STATION

Transporting large volumes of water through a piped distribution system requires the use of pumping stations.

Applications:
- Centrifugal pumps

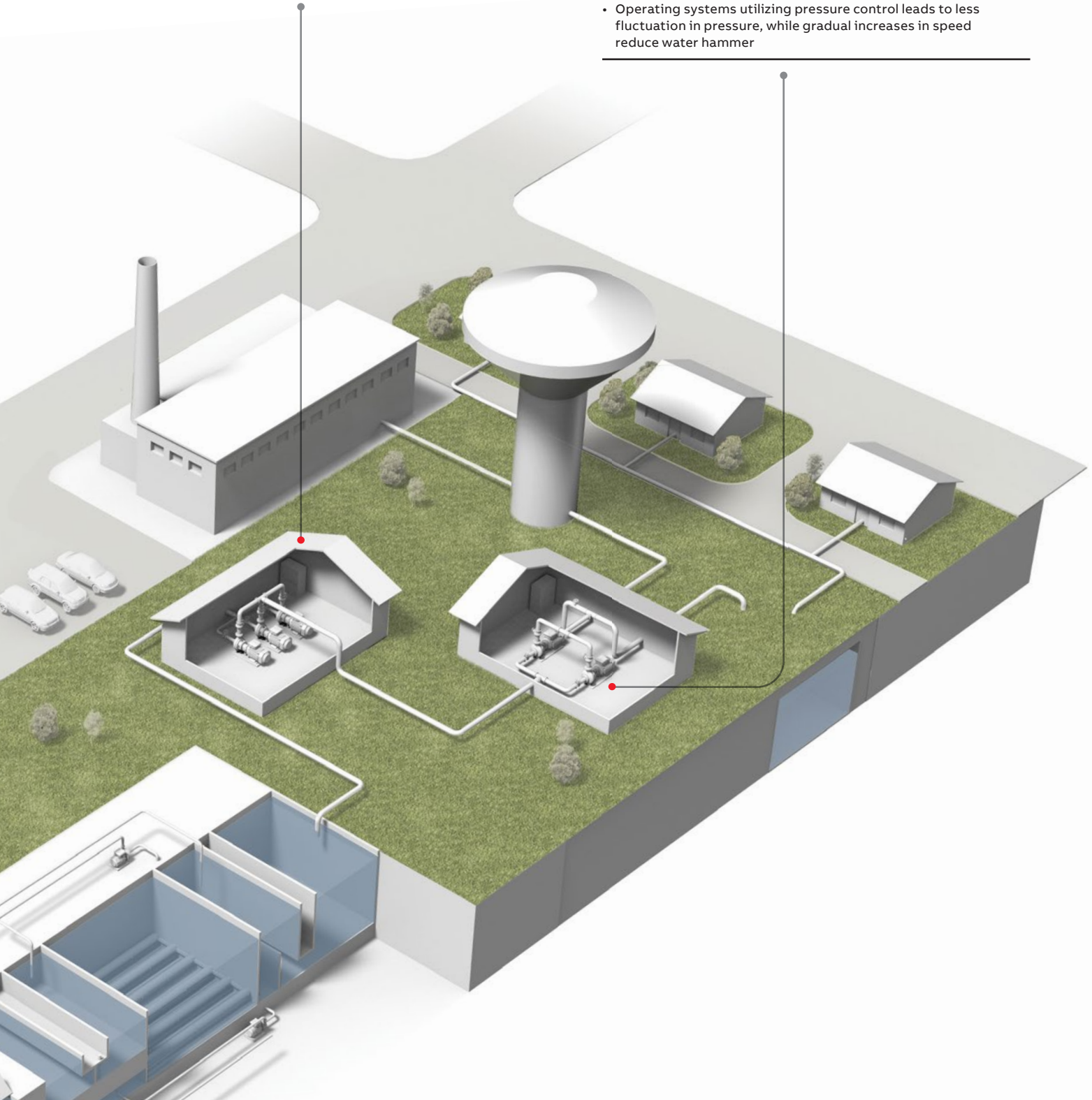
Requirements:
- To guarantee safe water quality, positive pressure must be maintained and controlled to avoid contamination

10 BOOSTER STATION

Booster pumps can be used when raising water pressure in a distribution system, such as pumping from ground level to a water tower.

Applications:
- Centrifugal pumps

Requirements:
- Booster stations raise water to overcome static lift due to higher elevation
- Operating systems utilizing pressure control leads to less fluctuation in pressure, while gradual increases in speed reduce water hammer



Unlock the potential in water applications

Alongside energy saving, improved productivity and greater safety, there are many other benefits from using variable speed drives (VSDs)/variable frequency drives (VFDs) and high efficiency motors on motor-driven applications.

	Challenge	Solution	Benefit
 **Pumps**	• Reduce energy use and carbon emissions	• Motor-drive: 80 percent speed saves half the energy, according to affinity laws	• Typically, between 20 to 60 percent energy savings compared to throttled control system
	• Variations in process demands	• Drive: Built-in multipump control function ensures operation of pumps according to actual demand	• Fast response to changing demand • Optimized energy consumption
	• Complex and mechanically controlled water networks	• Motor-drive: Simplify the water network by eliminating need for control valves, by-pass lines and instrumentation, with speed control, built-in protections and functions	• Reduces wear on motors • Reduces leaks caused by pressure surges • Lower maintenance and life cycle costs
	• Precise and optimal speed control	• Motor-drive: Enables the Best Efficiency Point (BEP) pumping	• Optimal pump efficiency
	• Direct-on-line starting creates pressure shocks that damages pumps, seals, pipe joints and valves	• Motor-drive and softstarter: Soft start of motor reduces stress on water and electrical network	• Reduced water hammer and other mechanical stress • Avoids pipe burst • Increased equipment lifetime
	• High cost when operating remote sites	• Motor-drive: Intelligent drives and smart sensors enable remote control and monitoring of pumps	• Anticipate operating lifetime of pumps • Reduce travel costs
	• Cavitation shortens the impeller lifetime	• Motor-drive: Software features to detect and prevent cavitation	• Allows for planned maintenance • Optimal energy efficiency
	• Risk of turbidity and total suspended solids (TSS)	• Drive-motor: Smoother start and optimize control in combination with a turbidity sensor	• Better quality of water • Reduced energy consumption • Reduction in lost water
	• Maintaining reliability in multistage/ bore hole pumps	• Drive-motor: Fast ramp to minimum speed	• Increased uptime • Increased service intervals
	• Pumping process continuity	• Drive: multipump control feature enables duty-standby pump operation – once the duty pump fails, the standby unit kicks-in	• Uniterruptable pumping for critical water applications
	• Mechanical & acoustic resonance, high vibrations	• Drive: Allows to skip resonance frequencies	• No high vibrations damaging the equipment • Quieter environment
	• Control redundancy	• Drive: In case of external communication loss, VSDs/VFDs can take over the control	• Pump will continue running in a preset local control mode, until the external communication is back
 **Blowers/ compressors**	• Over aeration	• Control the amount of dissolved oxygen	• Energy savings • Saving oxygen
	• High operation and energy costs	• Motor-drive: controls the dissolved oxygen • High-speed / Turbo blower drive technology	• Less mechanical wear • Better blower efficiency
	• Harmonics which can cause power quality issues	• Drive: Better blower efficiency • Ensuring ultra-low harmonic level in supply network	• Harmonic content is reduced down to 3 percent • Genuine unity power factor with no compensation needed.
	• Right amount of oxygen	• Motor-drive: variable speed allows accurate oxygen level control	• Better generator stability • Increased efficiency • Easy link to process control system • Exact amount of oxygen
 **Mixers**	• Better mixing quality	• Motors-drive: optimal speed control for the mixing operation	• Precise dosage and reduction of chemical waste

Critical functions that empower potable water plants

Drives, motors, PLCs, softstarters and service all play a vital part in keeping water flowing. Choosing the right product feature for the right environment is essential in ensuring an optimized production.

Variable speed drives/ variable frequency drives

Energy efficiency
- Control operating costs by seeing energy costs in local currency, kWh and CO_2 emissions

Communication
- Use information such as water flow rates to get the VSD/VFD to adjust motor speed and torque
- Get detailed insight into productivity performance and quality control through fieldbus comms connecting VSD/VFD with plant monitoring systems

Ingress protection
- IP55/UL Type 12 for wet and corrosive environments

Functional safety
- Safely stop pumps using in-built safe torque off (safety level SIL3/PLe)

Low harmonics
- Eliminate supply disturbances that could trip production with built-in active supply unit and integrated low-harmonic line filter
- Makes design and operation of the back-up generator easy and reliable

Pressure and flow control
- Ensure optimal operation of water asset with built-in VSD/VFD features

Multi-pump control
- Ensures stable and uninterrupted production with multi-pump controls by optimizing the speed and number of running pumps

Sensorless flow calculation
- Reduces costs by eliminating external components

Soft pipe filling
- Increases piping and pump system lifetime by avoiding pressure peaks

Level control
- Ensures optimal efficiency when filling or emptying a tank

Flow and pressure protection
- Protects pumping system from a low and/or high pressure and flow and prevents leakages/pump from running dry

Pump priority
- Achieves energy savings by alternating pumps based on pump efficiencies

Sleep boost
- Saves energy and extends pump life by decreasing start/stop cycles throughout the day

Quick ramps
- Reliable operation of submersible pumps and smooth operation of check valves

Anti-cavitation
- Extend the lifetime of the pump and pipes by detecting and mitigating cavitation

Softstarters

Prolong pipe and pump life
- Uses torque control to gently open and close valves and reduce water hammer during starts and stops

Protect pump system
- Motor preheat ensures a dry and warm motor, prolonging pump life and increasing uptime
- Coated boards and IP66 / UL Type 4x externally mounted keypads for harsh conditions

Simplify use
- Application wizards simplify commissioning and control of pump

Drive and motor packages

Synchronous reluctance motor (SynRM) and drive
- Save energy across the water treatment process with IE5 synchronous reluctance motors and drive packages

Drive and powertrain solutions
- Accessing from one source the drive, motor, transformer, switchgear and filters for mitigating harmonics and improving the quality of the network

Globally certified drives and motors packages
- Protect plant and people and conform to global regulations using tested and certified motors and drives for potentially explosive atmospheres

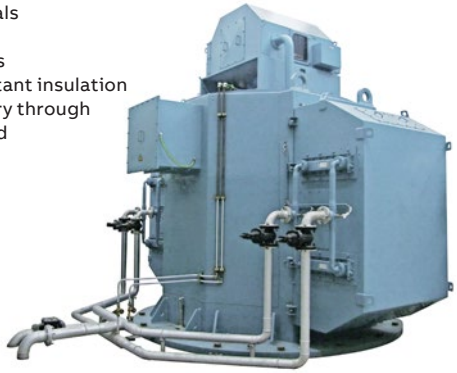
Low voltage motors

- Robust construction for outdoor environments
- Bearing locked at D-end to avoid axial play
- Bearings can be seals or regreasable
- 60 Hz or 50 Hz designs are available in IEC and NEMA frames
- Fan and motor fins optimized for low noise levels
- Oversized terminal box fitted as standard for ease of installation
- IP55 protection against ingress of water or solids with higher ratings as options. IP56 protection available as option.
- •Surface treatment (polyurethane or epoxy) in accordance with corrosion class C3, with C4 and C5 as an option
- IE3, IE4 or IE5 ultra-premium efficiency to support emissions reduction
- Suitable for VSD/VFD operation

Medium voltage motors

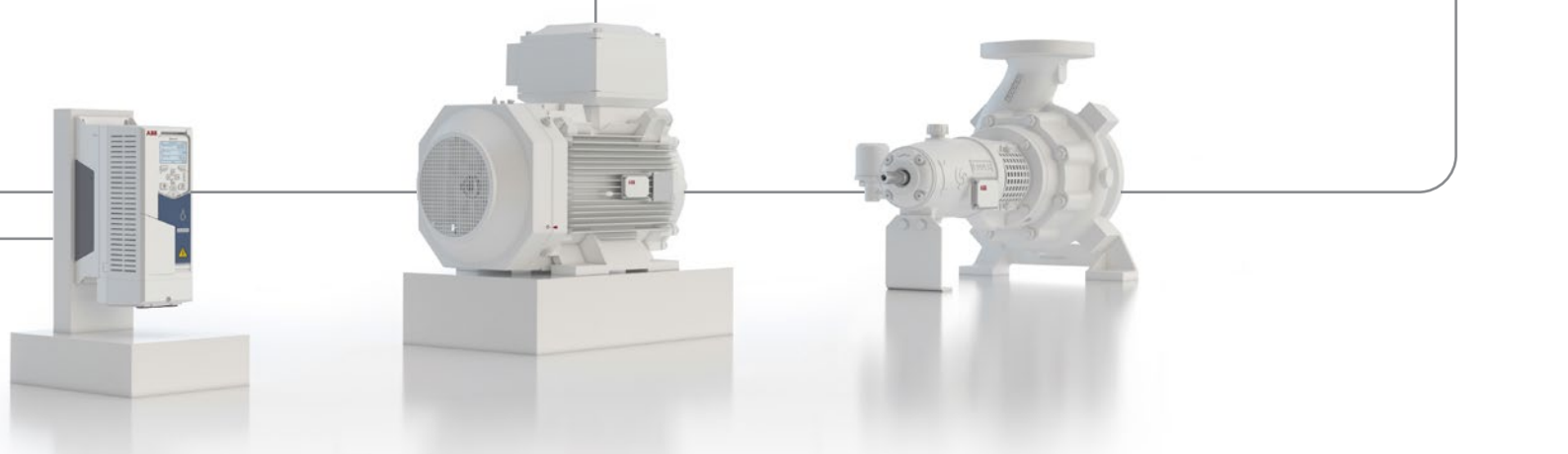
- Induction high voltage motors, modular and rib cooled platforms ensure short and on-time delivery
- High power density and efficiency reduces cost of ownership
- Compact size design enables a smaller installation footprint and lower costs
- Horizontal or vertical mounting
- Interface flexibility
- High grade of protection (upto IP66) for the motor and bearing reduce the downtime of plant

- Synchronous motors are designed for high reliability and long service intervals
- High efficiency
- Low noise and low vibration levels
- Extremely robust, moisture resistant insulation
- Full service from sales and delivery through commissioning to spare parts and maintenance
- Available both Direct On Line and Variable Speed supply
- Vertical and horizontal frames



Programmable logic controllers (PLCs)

- Comprehensive range of scalable PLCs, I/Os and robust HMI control panels delivering performance, quality and reliability
- Remote access helps reduce commissioning time
- One integrated engineering tool for programming, simulation and commissioning for PLCs, safety, drives, control panels and network
- Flexible choice of network and fieldbuses to integrate I/O's, drives, HMI, Scada and 3rd party devices
- S500 I/O System:
  - Cost efficient remote I/Os supporting different fieldbus protocols
  - Hot-Swap I/Os for increased availability
  - Fast integration into existing environment
- IIoT gateway functionality onboard the PLCs and control panels offer secure connection to cloud
- Cyber Security with AC500: Secure components with certified international standards (IEC 62443-4-1)
- High availability of AC500 HA prevents downtime and enhances system availability
- AC500-XC for eXtreme Condition (humid environments, high altitudes, vibrations, hazardous gases and salt mist)
- Automation Builder support configuration of drives and motion



From the factory floor to the cloud and beyond

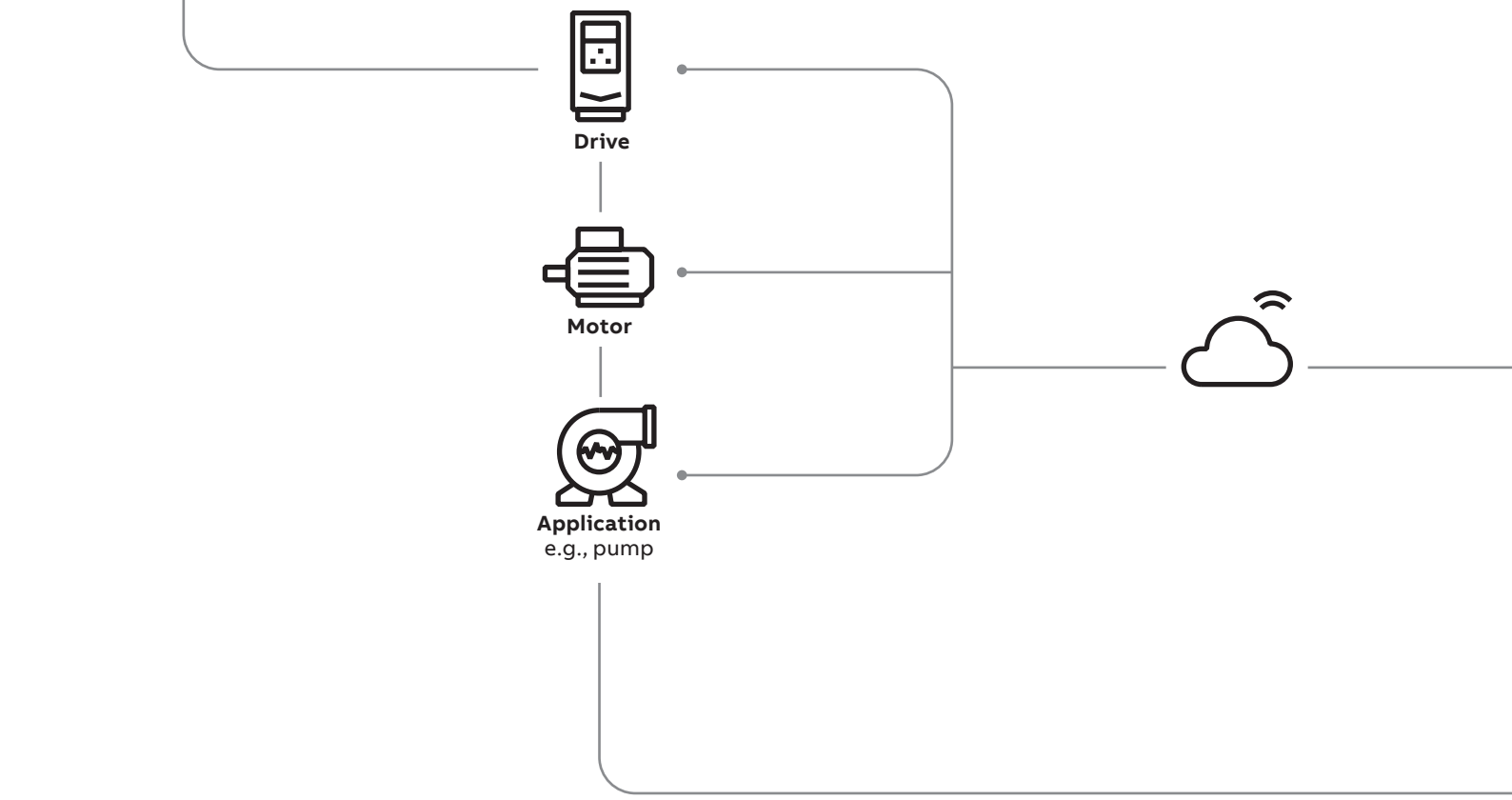
ABB Ability™ Condition Monitoring for powertrains optimizes the performance and efficiency of electric motor-driven rotating equipment. It enables better decision making by providing real-time access to data on all parameters for drives, motors and general machinery.

1 Intelligent powertrain

The powertrain is equipped with sensors and cloud connectivity and can consist of motors, drives and general machinery.

2 Turning data into valuable insights

Data gathered through VSDs/VFDs' built-in sensors and loggers together with that collected from ABB Ability™ Smart Sensors fitted to motors and general machinery, can be collected, stored and further accessed via the cloud. The ability to gather and analyze this data insights paired with service expertise can reveal information on the status and condition of your equipment, so that service activities can be scheduled more effectively.



Accessing data for analytics

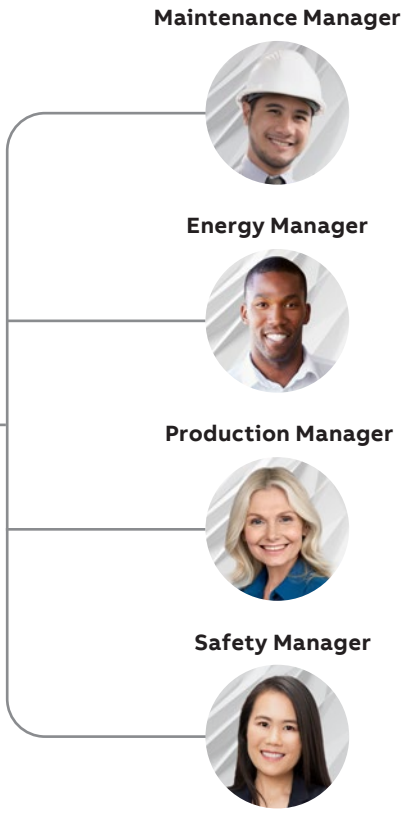
Detailed information can be extracted into a company's portal and systems. Information on many aspects of the clean water process is available, including the ability to know exactly when and how production equipment was cleaned. Detailed dashboards give full transparency so that you can take actions that lead to less downtime, extended equipment lifetime, lower costs, safer operations and increased profitability.

Gain a digital advantage

While the data is always at your disposal, ABB service experts can work with you to provide help on how you analyze the data and define the steps for improving your operations.

Ensuring that the right person is exposed to the right information at the right time brings:

- Appropriate response to production challenges, lowering operating costs and product waste.
- Greater insight into various aspects of the clean water process, thereby improving quality and reducing variations, errors and waste.
- Maximum material traceability helps fulfil regulatory compliance.
- Lower risk of production failure and change the maintenance from reactive to predictive.



Our service expertise, your advantage

ABB Motion Services helps customers around the globe by maximizing uptime, extending product life cycle, and enhancing the performance and energy efficiency of electrical motion solutions. We enable innovation and success through digitalization by securely connecting and monitoring our customers' motors and drives, increasing operational uptime, and improving efficiency. We make the difference for our customers and partners every day by keeping their operations running profitably, safely and reliably.

With a service offering tailored to your needs, ABB Motion Services maximizes the uptime and extends the life cycle of your electrical motion solutions, while optimizing their performance and maximizing your energy efficiency gains throughout the entire lifetime of your applications. We help to keep your applications turning profitably, safely, and reliably.

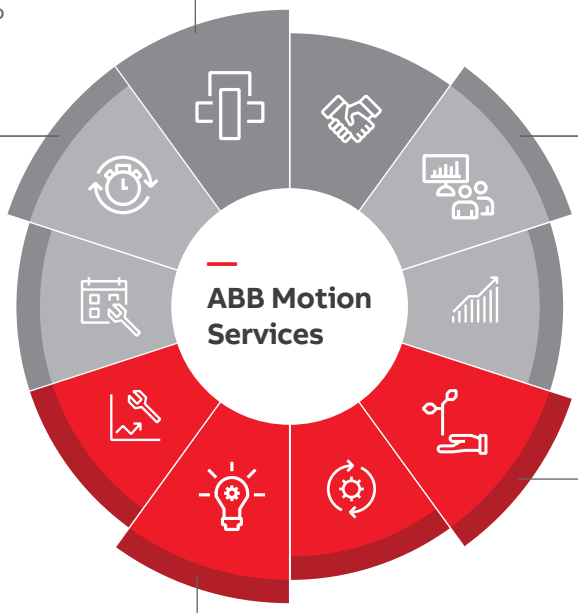
Digitalization enables new smart and secured ways to prevent unexpected downtime while optimizing the operation and maintenance of your assets. We securely connect and monitor your motors, drives or your entire powertrain to our easy to use cloud service solutions. Connecting your applications also gives you access to our in-depth service domain expertise.

We quickly respond to your service needs. Together with our partners, local field service experts, and service workshop networks, we provide and install original spare parts to help resolve any issues and minimize the impact of unexpected disruptions.

Our tailored to your needs service offerings and digital solutions will enable you to unlock new possibilities. Not only are we your premier supplier of motion equipment, we are your trusted partner and advisor offering support throughout the entire life cycle of your assets. We ensure your operations run profitably, safely and reliably and continue to drive real world results, now and in the future. Our service teams work with you, delivering the expertise needed to keep your world turning while saving energy every day.

ABB Motion OneCare:
The modular service agreement tailored to your needs

Recovery services:
Fast intervention when something goes wrong



Data and Advisory services:
Better desicion making

Energy efficiency and Circularity:
Reducing carbon emissions and waste
Driving the tomorrow

Digital and Innovation:
Delivering digital for success
Smart. Secure. Connected.

OUR EXPERTISE
YOUR ADVANTAGE

With you, wherever you are in the world

Partnering with ABB, gives you access to some of the world's most innovative technology, expertise and solutions.

Global reach
ABB operates in over 100 countries with its own manufacturing, logistics and sales operations together with a wide network of local channel partners that can quickly respond to your needs. Stock availability is good, with short delivery times for many products backed by 24-hour spare parts delivery.

In addition, we work closely with pump suppliers and OEMs to develop custom products, services and solutions to help standardize processes across multiple sites and streamline your processes.

We have several global R&D centers with thousands of technologists and considerable investments annually on innovation.

End-to-end product portfolio
Alongside its variable speed drives (VSDs)/ variable frequency drives (VFDs), motors and soft starters, ABB's automation offering includes a wide range of scalable PLCs, a selection of HMIs, instrumentation and robotics. With functional safety options, from built-in safe torque off in drives to safety PLCs, you can readily implement safety requirements.




ABB's offering includes:

- End-to-end **power and automation solutions**, from power distribution, raw material receipt, to process and machine control, to end of line packaging
- **Power protection and power quality solutions** to safeguard equipment and processes
- Industry leading **robotic automation solutions** that improve your speed-to-market, flexibility and help make packaging a differentiator
- A complete range of **protection, connection and wire management solutions** that withstand harsh environments and extreme temperature swings, and provide the reliability needed for continuous operations

Streamline sourcing

ABB's end-to-end product and services portfolio streamlines your sourcing and purchasing activities and standardizes production across multiple sites, saving you money on spare part inventories while reducing maintenance costs.

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For more information, please contact your local ABB representative or visit

new.abb.com/drives
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